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Hegadekatti, Kartik and S G, Yatish

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THE PROGRAMMABLE ECONOMY: ENVISAGING AN ENTIRE PLANNED ECONOMIC SYSTEM AS A SINGLE COMPUTER THROUGH BLOCKCHAIN NETWORKS

Dr.Kartik H & Dr.Yatish S.G

Authors' Email: dr.kartik.h@gmail.com; dryatish.blr@gmail.com

ABSTRACT

Since the dawn of the concept of nation-states, many nations have been planning their economies to increase people's prosperity and standard of living. All economies have a centralised feature where decisions are taken. But data collection and plan implementation has been cumbersome because of the manual nature of economic planning. Centralised systems, even when digitised, are prone to single point failures. Controlled Blockchains allow for an economic system to be decentralised, yet having central supervision i.e. quasi-decentralisation.

This paper deals with shifting a national economy to a network of Blockchains and creating a Programmable Economy (P.E) where the whole economic system behaves like a single computer, taking in certain inputs and providing the desired outputs.

We discuss the various factors that are needed to bring about such a transformation. We also analyse the impact this will have on various aspects of the economy and people's lives. Finally the paper concludes by summarizing the purpose, methodology and impact of a Programmable Economy (P.E).

INTRODUCTION

A cryptocurrency is a medium of exchange using cryptographic techniques to safeguard transactions and also manage the formation of additional units of the currency.

A Blockchain is a widely disseminated archive of data that maintains a continually-expanding register of records fully and reliably protected from any alteration or modification. Each block has a timestamp and link to the preceding block. A Crypto wallet is an encrypted electronic device that allows an individual to make electronic cryptocurrency transactions.

Each wallet will have a public key visible to anyone. But it can be operated by only a person who has a private key. Transactions on the cryptocurrency network are usually anonymous. When people send cryptocurrencies to each other, someone has to keep account of who spent how much at what time.

In case of fiat money (or paper money) it is done by banks (known as Trusted Third Parties, for which they charge a commission). But in case of Cryptocoins, it is registered on a ledger called Blockchain (with nil or minimal fees).

The cryptocurrency network makes this possible by detailing all the transactions made during a certain timeframe into a list. This list is known as a block. A certain set of people called 'miners' verify these transactions mathematically and register them on the Blockchain.

Those bona-fide miners who have successfully verified the transactions are paid freshly created Cryptocoins. This is how miners are rewarded, and new cryptocurrencies are generated. This is also the reason why no transaction costs are levied, as the network (in the form of miners) verifies the transactions.

Bitcoin is a peer-to-peer based cryptocurrency which is not backed by any commodity and (unlike fiat money) carries no sovereign guarantee whatsoever. Regulated and Sovereign Backed Cryptocurrencies (RSBC), on the other hand are government backed cryptocurrency akin to paper currency, but in digital form.

In this system, the cryptocurrencies (known as NationCoins) are backed by Sovereign Guarantee. They are run on a highly secure Controlled Blockchain (CBC) ^[1]. NationCoins are completely managed by the Sovereign Authority i.e. the Government. This system is based on the K-Y Protocol ^[2]. The K-Y Protocol is a set of rules and instructions to implement the Regulated and Sovereign Backed Cryptocurrency (RSBC) system.

(A Blockchain Economy (BE) is one where majority of economic activities takes place on the Blockchain)

The present, existing monetary system is highly centralised. There is a central authority (The central bank, which represents the sovereign authority) which issues fiat currency, regulates various financial institutions and directly/indirectly controls and guides the national economy on a desired favourable path. But the control is not total or to the level so as to provide a favourable outcome at all times. Several factors affect this milieu.

(1) In an economy which has a great proportion of its money in the informal sector, it becomes difficult to monitor, control or direct the flow of cash or capital. This necessitates reliance on concepts like trickle-down economics which have been found to be counterproductive ^[3].

(2) The presence of a large unorganised sector also necessitates reliance on the banking system which acts as an intermediary between the central bank and the people. This intermediation comes at a cost-

namely transaction costs and high interest rates which reduce the productivity of capital and curtail credit capabilities of the economy.

(3) Dependence on the banking system for Fractional Reserve Banking^[4] has its own pitfalls. A great amount of efforts, time and resources have to be expended by the Sovereign Authority to control money multiplication [Through FRB] using strict, direct and indirect regulations.

(4) On the other hand, an unregulated market and banking system will lead to events like the 2008 recession that led to contraction in size of many great economies.

(5) Lack of a credible monitoring and surveillance system led to the “sub-prime” mortgage crisis that triggered the 2008 recession^[5].

The present economic system is thus centralised in nature. It is prone to single point failures i.e. a failure by the central authority has a cascading effect on the whole economy. Moreover, due to the centralised nature of the setup, any failures have to be corrected by the central authority alone. Local solutions can only be temporary in nature. Thus, self-correcting mechanisms are lacking in a centralised (i.e a central bank) economic system.

Another disadvantage of a centralised economy is that the product outcomes are difficult to predict. This is due to a number of reasons

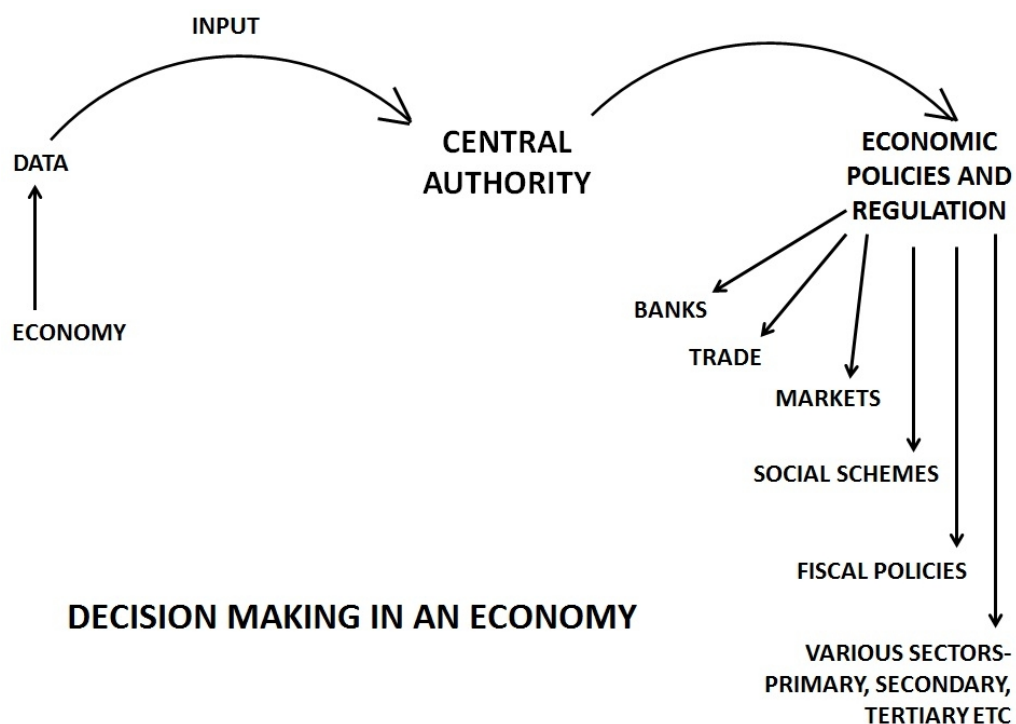
(1) Most of the times, the data collected is not real-time. In a dynamic economic situation where the events take place on a day-to-day basis, real time data is necessary to predict outcomes and influence situations. In a centralised economic system, data is collected from the periphery. This takes time and does not accurately reflect economic realities on the ground. For example, in many countries, unemployment data is obtained on a monthly or quarterly basis whereas it will take only a few days for a recession to kick in.

(2) The data that is collected is not 100% accurate as it is a sample set or the result of a survey, which does not reflect the data set as a whole. For example (in many developing countries) unemployment data is only an estimate based on a survey.

(3) As data collection and statistical analysis is manual (even though, done by computers, data collection, feeding, reporting, supervision etc is manual) the data analysis process is prone to errors in many places and various levels.

(4) The data collection process, (which itself involves manual work) is a cumbersome process. This adds to time delays and additional costs. Consequently, the data obtained is not real time, does not reflect the full picture (due to sample nature of data) and is costly.

(5) All the above makes it possible for unscrupulous elements to sabotage the data. Thus, data integrity is compromised at various levels. Therefore, data at input level is itself not trustworthy or integral enough to provide a basis for credible action.



A big problem that developing countries face is poor tax compliance. Due to the informal and unorganised nature of the various sectors developing nations have poor tax compliance. A large economy like India (with a 1.25 Billion Population) has only 7.6 million people paying taxes ^[6]. The taxation infrastructure is under staffed. Data on tax evasion is unreliable. Added to this milieu there is rampant tax evasion. The evaded tax makes its way into the parallel economy leading to inflation and distortions of various other economic parameters. To solve this problem, the government of India attempted Demonetisation ^[7]. Demonetisation has proved to be a shock to the economy ^[8]. The root cause of the problem (i.e a lot of cash in the economy) still persists. We can therefore see that an economy awash with cash causes many problems that complicate the macroeconomic environment of the economy.

(However efficient the taxation mechanism, a cash based and centralised economy has to depend on and trust the taxpayer to file his/her returns and remit the taxes in either cash or other forms of paper money.)

The central authority also faces a dilemma in that, if it increases the tax rate, more people who were otherwise paying taxes will start to evade it. If it decreases the tax rate, its collection will fall due to extant poor tax compliance. Hence there is a need to shift to an automated, trustless and reliable tax mechanism [If all those who pay taxes suddenly evade or stop paying taxes, it will become very difficult for the central authority to enforce tax laws due to its underdeveloped infrastructure]

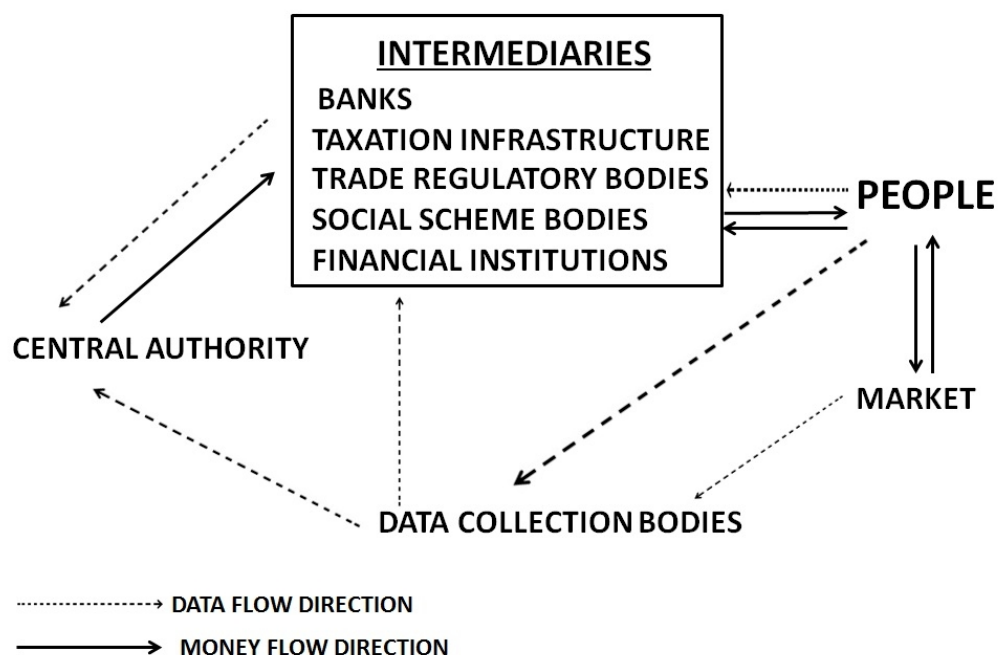
In case of social schemes too, the central authority faces many problems. Data collection being a major impediment, it is also important to ensure that the benefits reach the intended beneficiaries. But this seldom occurs. A majority of social scheme beneficiaries do not have a bank account (in developing nations) due to poor banking

penetration ^[9] Those who have bank accounts do not know how to use them due to prevalent financial illiteracy ^[10] . Moreover, existence of a large number of intermediaries in the social scheme supply chain leads to pilferage and loss of resources ^[11] .

Amidst all the above scenarios, it becomes extremely difficult for the central authority to collect data, supervise and implement policies and regulations for the economy as a whole. The bureaucratic setup needed for such a function will also be large and the process, tedious.

Digitisation of records and data will ease the process, but data would still have to be collected manually, fed manually and will be of a sample/survey in nature. All of these will compromise data integrity to some extent, preventing the central authority to obtain the full, real time picture of the economy. This will hamper the implementation of a viable economic plan which can give an optimum output.

The policies to be implemented will also be cumbersome and involve many intermediaries. Moreover, the central authority will again have to rely on the same data collection infrastructure to gauge a suggested economic plan



We propose to implement a Programmable Economy (P.E) through the Nationcoin system based on the K-Y Protocol. This will provide a unified Blockchain for the whole of the national economy. It will ensure a real-time data collection from the entire economy providing a full picture of the economic state of affairs. Since the whole economy is on the Blockchain it becomes easy for a Sovereign Authority to implement policies and regulation in a programmed manner with known outputs and also gauge its impact concurrently. It will result in direct interaction of the Sovereign Authority with the people with minimal red-tape and maximal optimization of economic benefits. Intermediaries at various stages will be greatly minimized if not totally eliminated.

A Programmable Economy (P.E) will be such that input of defined parameters will provide a definite tangible desired output with real-time monitoring and simulation. In short, the economy can be “programmed” to behave in a manner which benefits maximum number of people in minimum amount of time at reasonable cost in a sustainable manner.

In a Programmable Economy(P.E), it will be possible for the Sovereign Authority to input certain desired parameters into the Blockchain and gauge the output that will be consequent upon the input. [On the other hand, it will also be possible for the Sovereign Authority to state the desired output and evaluate the required inputs]

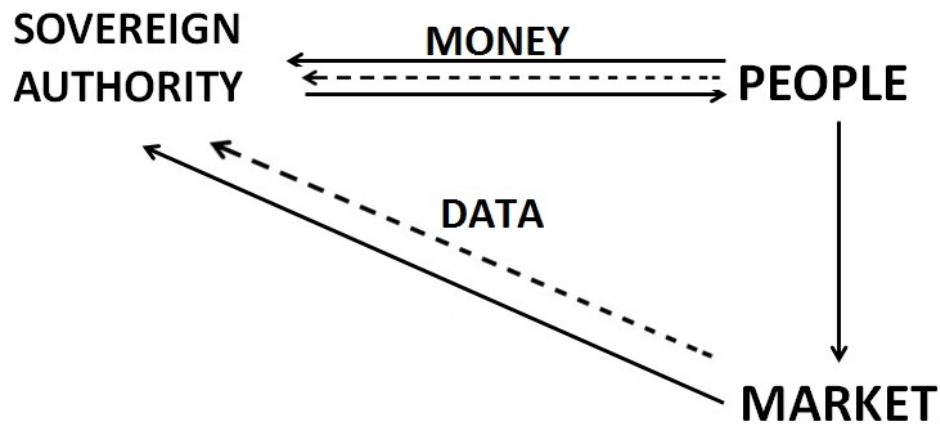
For example; the government (Sovereign Authority) inputs that the tax rate is decreased by 10%, GDP increases by 3% and so on. The controlled Blockchain system will simulate the economy and provide output, like (based on above input) poverty level will decrease by x%, unemployment will decrease by y% etc. over a 1, 5, 7 or 10 years period. The Sovereign Authority can then adjust input based on desired outcome (for instance; government wants poverty level to decrease by

z %) and give a command for implementation. The Blockchain economy, then, acting like a single computer will execute the instructions to provide the desired outcome. Consequently, the people (in the economy) will experience and witness certain changes in tax rates, interest rates, price of certain commodities etc. which will in the end provide a result consistent with the desired outcome of the Sovereign Authority. If the Sovereign Authority mandates that poverty levels should fall by b%, unemployment level should fall by c%, GDP should rise by m% and so on, The Controlled Blockchain system will simulate the desired outcome backwards and provide Sovereign Authority with likely inputs that will lead to the desired output.

In essence, we are transforming the entire economy into a single entity akin to a computer with the various stakeholders (i.e. the people) behaving like independent yet interacting data points.

The Controlled Blockchain (CBC) will be able to simulate the real economy because during implementation of the K-Y protocol, a huge amount of data will become available. This will allow us to subject this large data to analytics and start programming the network to keep watch on certain data points which have some effect (discernible or not) on the economy. Machine learning algorithms will be implemented on the CBC to ease the collation, analysis and pattern recognition of data and enable simulation of various economic scenarios.

Supercomputers can also be used for modelling economic scenario-based situations provided by the CBC. But it might end up providing a single point for failure i.e. the supercomputer. Moreover, a single supercomputer does not provide opportunity for data consensus that is possible on a Blockchain. That is why the economy must preferably be hosted on a CBC.



The major advantage of a Programmable Economy is that the economy itself provides the data in real-time.

Programmable Economy will be an automated economy in which the whole economy functions automatically without (or with minimal) external supervision, self-correcting to attain the goals of the desired outcome i.e. inclusive economic development.

How the Programmable Economy provides ready real-time data?

In a Blockchain economy, each person will have a wallet-which is a family of addresses where RSBCs are held.

It is possible for a Sovereign Authority to view data about the wallets without knowing the identity of the wallet holder. On a large scale involving hundreds of millions of wallets, we can view the flow of cash from one wallet to another. This reduces the whole economy to an objective data set where a statistician can choose and categorise data as per her requirements and mandate for study.

For example; In a social setup assume that everyone has an RSBC wallet. Say, that a certain group of people buy food items. This is recorded on the Blockchain. Now it will be possible to find out as to which income class bought what kind of food stuff. This enables the Sovereign Authority to target health and nutrition schemes to a particular group of people which needs them. The present centralised cash and bank based economy provides no scope for such objective

exercise. And in a Programmable Economy, all of this data can be sought in real-time. Data can be collated from the Blockchain on a daily, weekly, monthly or yearly basis and so on.

ADVANTAGES OF A BLOCKCHAIN ECONOMY

(1) It is decentralised- due to its decentralised (or Quasi – Decentralised) nature, a Blockchain Economy (BE) is immune to single point failures. This increases the reliability of the network and reduces scope for any ad hoc nature of policy or regulation, as consensus among ‘nodes’ will be necessary for optimum functioning.

(2) High and robust security- This is again a consequence of the decentralised nature of the BE

(3) Real-time data collation is possible.

(4) Data collated will reflect the complete economic picture and will not be a sample/ survey type of data whose integrity is questionable.

(5) A single setup for various classes of economic activities- In a BE, a single setup i.e. the RSBC network is sufficient to cover almost all classes of economic or social activities for example; land transactions (selling or buying of land) can be done on the RSBC network itself. Birth and death registry, vehicle ownership, electioneering, certification, record depository, judicial and forensic evidence (through Proof-of-Existence) ^[12] etc. can be done on a single decentralised network i.e. the RSBC network.

(6) IoT (Internet-of-Things) and machine based taxation is possible. In a BE, machines will have a virtual identity. Coupled with ‘mining’, machines will be independent earning members of society. As such they will be part of IoT. Taxation of machine earnings (through ‘mining’ or services) will be possible only through a BE and not the present system ^[13]

(7) Simulation of the economy is possible- Due to the wallets being connected to the network during transactions, data on wallet activity can be obtained. Over a period of time this data will be substantial enough in (quantity and quality) for purposes of modelling the economy. Such models will provide the basis for simulating the various scenarios of the economy when given various inputs. This is not possible in present economic setup as data sets are fragmented (i.e not reflective of the whole economy) and their reaction to new economic contingencies cannot be accurately predicted.

(8) BE allows the economy to be programmed like a single computer to achieve desired output i.e. inclusive and sustainable development.

Cashless economy in a centralised format (as being tried in some nations through demonetisation) will be very difficult to implement due to various reasons.

(1) Involvement of banks and financial intermediaries which charge a transaction fee whenever a citizen uses electronic transfer at point of sale.

(2) Accounts of citizens are hosted on centralised servers making them prone to security risks.

(3) Certain restrictive policies practiced by banks and financial intermediaries curtail financial freedom of common man. Example: insistence on minimum balance in account.

(4) Transaction times are long and cause delays in economic activity For instance- it takes few hours to a day to transfer money from one account to another.

(5) Banks and financial intermediaries create a third party barrier by coming between the government and the people, thus direct transfer of benefits from government to people become difficult.

Blockchain economy on the other hand provides scope for cashless, digital, decentralised, open economy with zero transaction fees, very fast transactions and unconditional account management. Third parties like banks are eliminated and governments can directly interact with people in the financial sphere.

PRE-REQUISITES OF A PLANNED ECONOMY ON BLOCKCHAIN

(1) Migration of economy to the RSBC platform.

As envisaged by the K-Y protocol, a large economy (of a Trillion Dollar GDP) can shift to the RSBC platform in about 7-10 years. The end result will be that the majority of the economy will be cashless, digital and decentralised.

(2) A Planned Economy Committee (PEC) consisting of certain members (Details explained later) to guide the Programmable Economy. The PEC will have political, technical and economic oversight on the Programmable Economy.

As we can observe, there are minimal requirements to transform a nation into a Programmable Economy. Hence, it is feasible to implement it in over a decade or even earlier.

VARIOUS PARAMETERS OF THE PROGRAMMABLE ECONOMY

As already discussed, the Programmable Economy will be like a single computer with input and output parameters. It is a known fact in economics that each economic indicator/parameter has its own impact on the end result i.e. GDP or per capita income. For example, increasing bank rate may mop capital from the economy, thus leading to a deflationary scenario. (Provided the other parameters remain same or within a range).

The various major and minor economic parameters will be hard-coded into the P.E (Programmable Economy) in order to provide simulation

and also execute economic functions. Some of the parameters coded into P.E include (not exhaustive)

- (1) GDP.
- (2) GDP/capita
- (3) Bank rate
- (4) %cash circulating in economy
- (5) Inflation indices
- (6) Per capita income
- (7) Poverty levels
- (8) Income tax rate
- (9) Interest rates
- (10) Custom duty/excise rates
- (11) Money supply
- (12) Fiscal deficit
- (13) Social scheme funding.
- (14) Various surcharges and cesses
- (15) Sector-wise income distribution and earnings
- (16) Employment rate
- (17) debt/GDP ratio.

The above parameters will be on both the output and input side of the simulation. The impact and interplay of the various parameters will become evident on collating data from the Blockchain economy. Subsequent running of simulations over a period of time will improve the precision of scenarios suggested by the P.E.

ECONOMIC ACTIVITIES IN A PROGRAMMABLE ECONOMY

As a BE transforms into a P.E. We can expect that a whole new class of economic activities will emerge. Value addition will be higher (add in the end) of minimal cost. Existing financial activities will undergo a radical transformation.

We shall now analyse the consequences of such a transformation on the various sectors like-

- Banking
- Taxation
- Employment
- Social schemes
- Capital markets
- Digital personal records
- Non money sectors – land, vehicle
- Right-To-Money implementation
- Right-To-Machine implementation
- Elections
- Predicting future economic scenario
- Insurance
- Credit rating
- Forex markets
- Government services – contracts
- Judiciary/large services

- Certification
- Automated auditing

CENTRALISED ECONOMY

(CASH,MANUAL,MANY INTERMEDIARIES,FRAGMENTED)



CENTRALISED DIGITAL ECONOMY

(CASHLESS[DIGITAL],MANUAL,MANYINTERMEDIARIES,FRAGMENTED)



BLOCKCHAIN ECONOMY

(DIGITAL,AUTOMATIC, DECENTRALISED,NOINTERMEDIARIES,SEAMLESS)



PROGRAMMABLE ECONOMY

{ECOSYSTEM OF INTERLINKED BLOCKCHAINS}

(THE ENTIRE ECONOMY AS SINGLE VIRTUAL MACHINE)

(A) BANKING

As a B.E transforms into a P.E, the role of banks will undergo a radical transformation. The following changes will take place.

(1) Role of banks as a money multiplier will greatly decrease. FRB will play a very minor role in increasing money supply in the system. ^[14]

(2) Banks will hold lesser and lesser number of bank accounts as all the citizens will have access to RSBC wallets at zero cost.

(3) Banks will face competition from the common public in providing loans. That is because, in a Blockchain economy, people can lend their savings directly to credit-seekers at a very competitive rate. Loan return and interest compliance will be enforced by the Programmable Economy itself.

(4) Banks will no longer be the Trusted Third Party (TTP) as its functions will be fulfilled by the Blockchain. Instead, banks will become the Verifier of First Resort (VOFR) verifying credit credentials of the citizens who provide and consume financial services. ^[14]

The Programmable Economy will reduce the role of FRB to a minimum. Banks will still have a role in the economy, albeit a different one. Banks will be transformed into Trusted Fourth Parties (TFPs) Verifier of First Resort (VOFR) who will have the responsibility of certifying credit-worthiness of individuals and other legal entities in a Crypto-currency dominated economy.

(5) Whatever little original functions that will remain, will be subsumed by the P.E and will be regulated by it. Various banking parameters will be part of the algorithmic programs that will be coded to provide an optimal end output i.e. inclusive sustainable development.

(B) TAXATION:

Programmable Economy will usher in an Automated Tax Regime (ATR). In a ATR; citizens will not be filing any tax returns. Since their wallets are visible to the P.E, it will automatically compute the taxable amount and periodically deduct the money from the wallets. This has many advantages.

(1) Almost 100% tax compliance-

As all the wallets will be visible to the Sovereign Authority, the flow of money in the economy can be monitored. Due to non-use of cash, people will be obliged to use Nationcoins. Hence, they cannot hide or hoard the money out of reach of the Sovereign Authority.

(2) Widening the tax net- A large number of people, hitherto not covered under the tax net will now come under its purview due to the wallets (and the money in it) being visible to the Sovereign Authority. This will increase tax collection.

(3) Reducing the tax burden- As more people come under the tax net, each person will have to pay lesser taxes for the government to reach its tax target. This reduces the tax burden on each individual leading to increased individual savings and increased disposable income.

The ultimate aim of P.E will be to achieve a Zero Tax or Minimal Tax Regime. This will be possible if all probable transactions in an economy take place on the Blockchain. If that happens, then the Sovereign Authority can charge a very tiny percentage of each transaction as transaction tax (different from transaction cost). This will reduce the tax burden even further. Eventually it may be possible to phase out income tax altogether and realize revenue solely through transaction tax alone.

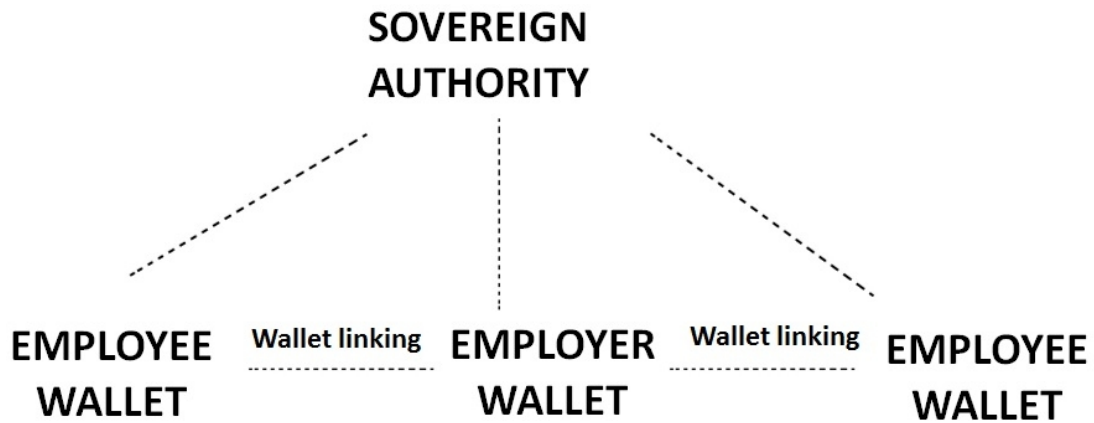
(4) Reducing the size of the parallel economy: Since people will no longer be able to hoard money and evade taxes, there will be a fall in quantum of money fuelling the parallel economy. This will help in battling the ills of a large parallel economy.

(C) EMPLOYMENT:

The employment rate will be easier to compute as the Sovereign Authority will have the wallet details of both the employer and employee. Based on this data, governments can have real-time information (on a daily basis) as to what percentage of the population is employed or unemployed. This will enable the Sovereign Authority to introduce targeted employment schemes to benefit the people.

Collating Employment figures-

Wallet linking-Through this process, wallet of an employer is linked to his/her employee through which payment is made from employer to employee. By knowing the number of links between employer and employee, the Sovereign Authority can calculate the number of people employed in a particular enterprise.

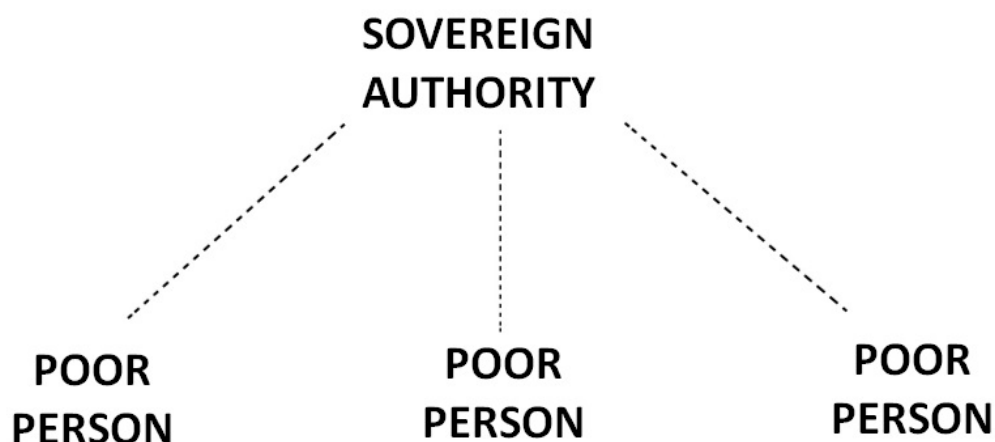


Minimum Wage Rule can also be implemented through this route. Since the wallet payments are visible to the Sovereign Authority (without the identity of the employer), the government can ensure that the employer is paying minimum wages to his/her employees. Thus enforcement of the minimum wages act (or other similar legislations) is ensured.

If any employer is found not to be obeying payment or labour rules, the Sovereign Authority will be informed of his/her identity by the PE. The employer can later be counselled to comply with the rules.

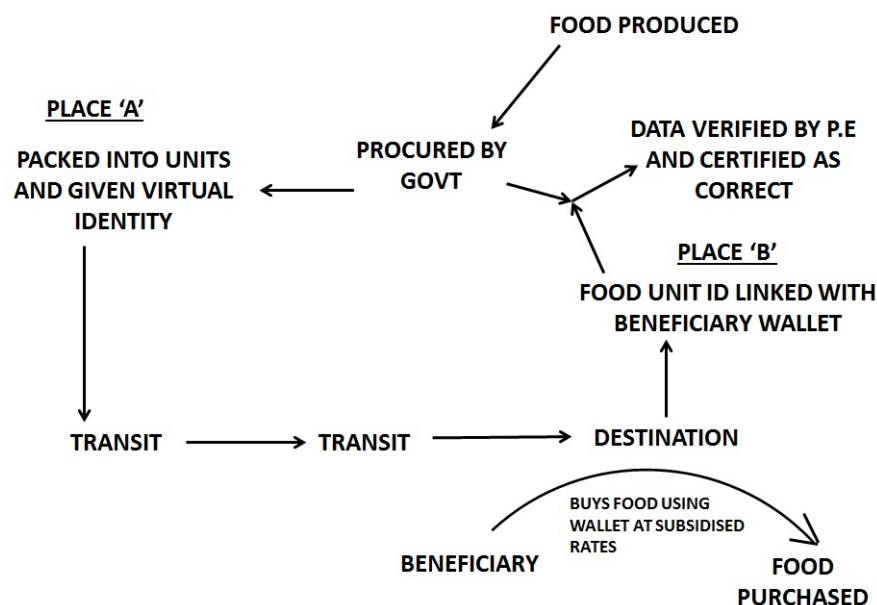
(D) SOCIAL SCHEMES:

Since banks and financial intermediaries will be all but eliminated in a PE, the governments can transfer social benefits directly to the needy without wastage, pilferage or loss of resources.



Direct benefit transfers (DBT) will become very easy. It can also be ensured that the money given to needy persons as part of social benefits is spent in a reasonable manner. The money can be programmed only to buy essentials and other necessary items and not luxury or addictive items (like alcohol or cigarettes).

Public distribution of food grains can also be streamlined. Packed units of food grains can be given a virtual identity which can then be hosted on the Blockchain. The buying of the packed unit at the end point by the beneficiary will be Proof-of-Supply as we can consider that the packed item was bought by the beneficiary. This also makes it possible to calculate the exact amount of subsidy given to each beneficiary and spent on every unit of food grain consumed.



The advantage is that the government can verify whether food has reached a person above or below poverty line and that he/she is the actual intended beneficiary (by checking with previous database and wallet ID verification).

The beneficiaries need not have a personal electronic device to operate their wallets. They can do this through Blockchain interaction units (BIUs) that will be set up by the government in remote areas and villages and can be operated like ATMs ^[15].

(E) CAPITAL MARKETS

As the B.E becomes a reality, capital markets will no longer have to depend on financial intermediaries to raise capital for their ventures. The world got a glimpse of a future capital market scenario when the DAO became the largest crowd-funded enterprise in history raising more than \$150 million in 30 days without the involvement of any financial intermediary ^[16]. This was possible because of Blockchain technology.

Companies intending to raise money from the public will call ICOs (initial coin offering) where cryptocurrencies will be offered for a price. These cryptocurrencies will be similar to shares and can be freely traded on cryptocurrency exchanges across the world. The companies will have their credit rating assessed by banks which will have transformed themselves into Credit Rating Agencies for Blockchain Enterprises (CRABE). Based on their ratings (which will be objective and recorded on a Credit Rating Blockchain for sake of transparency and integrity), the public can invest in these ICOs.

This also provides the advantage that any person anywhere on the globe can invest in any enterprise on earth. A person in a remote place in Namibia can invest in a start-up in Europe or vice-versa. There will be minimal barriers and high competition which will lead to the best company being the winner. Such free flow of money and investment will happen without financial intermediaries or transaction costs leading to more efficient utilization of funds for investment.

(F) IMPLEMENTING THE RIGHT-TO-MONEY:

Right To Money concept means a fundamental right where every individual is guaranteed a basic income in proportion to the amount of automation in an economy ^[17]

In a P.E, the Sovereign Authority will know exactly who has lost job because of what reason. Social security schemes will then automatically kick in and transfer money to the wallet of unemployed person subject to certain conditions. Thus Right To Money can be ensured.

Similarly, Right To Machine can be implemented based on the digitized personal records on the Blockchain.

(G) BORROWING AND LOAN MARKETS

The P.E will open up global borrowing and loaning capabilities of the general public. By using smart contracts built into the B.E, people will be able to directly loan or borrow money directly from other people. As vehicle and land ownership details will be hosted on the Blockchain, mortgaging and collateral accounting will become automated. This will result in obtaining of loans at a competitive rate across the globe.

For example; A person wants a loan of a few thousand dollars. He can obtain that loan from a person who is ready to provide that money at a cheap rate of interest. Say, a person X in India can obtain a loan from a person Y in Japan over the Blockchain. If A is unable to return the money, the collateral will be transferred to B's account. He may sell it or rent it (again on the Blockchain) to realise his/her money.

Thus, instead of being at the mercy of banks and financial intermediaries who charge a high rate of interest, the people can directly obtain loan from the public at competitive rates across the globe.

(H) CREDIT RATING

In a P.E, every person who owns a wallet will have a Credit-Rating based on his/her previous transactions and financial habits. This will ensure that people who loan (or borrow) money conduct financial transactions with people having high credit rating that reflect their financial integrity. This has huge social implications as well.

(1) Financial integrity will be incentivized. Those who have high credit ratings can obtain loans (from public) at lower interest rates and can lend money at higher interest rates.

(2) The Sovereign Authority can pinpoint with precision as to who all are the members of the public who are wealth creators and those who are speculators and tax evaders.

The P.E will automatically compute concurrent credit rating where members of the general public, corporations as well as local governments can be evaluated based on their financial integrity. This will give rise to a new kind of market – credit integrity markets, where people can monetize their credit rating and invest in ICOs or separate trading platforms. As the credit-rating is real time, the credit integrity markets will be dynamic and credible enough so as to reflect the overall trust or financial integrity of a system or nation.

For example: If a person, A, has a credit rating of 90 (out of 100), then he can monetize his credit rating by releasing 90 credit shares into the market (or 9000 based on market feasibility). These credit shares will be bought by the investors. Now there will be a financial incentive for 'A' to maintain a high credit rating, as any fall in his rating will lead to him losing money on the credit integrity market. 'A' can also buy B's share, B can buy C's share and so on leading to a situation where each person is invested in the credit rating of another person. Thus a large network of people (invested in each other's financial integrity is created). This will lead to a highly stable market with great trust and objectivised financial integrity which will be good for the economy in the long run. The overall trust in the economy will increase.

(I) DIGITAL /PERSONAL RECORDS

Legal and financial documents like Birth certificate, marriage registration, pay slips etc can be hosted on the Blockchain. This will ensure easy verification and certification. Courts can verify documents

through Proof-of-Existence [12] in minimum time. After the death of a person, his/her will can be executed on the Blockchain leading to minimal inheritor grievances or ambiguous litigations.

(J) INSURANCE

It will be easier for insurance companies to sell their policies as customer credentials can be verified by the P.E. The insurance companies will pay a small fee per customer to Sovereign Authority for verification services. Coupled with real time credit rating, insurance companies can streamline their premium fixation policies. Premiums can even be made dynamic to reflect the real-time nature of customer data.

It will also be simpler to dispose of insurance claims with minimal delays through P.E.

(K) NON-MONEY SECTORS

Land, vehicle or property ownerships can be achieved on the Blockchain. This can be done by assigning digital identities to property units which can then be operated using virtual keys by the owners. Essentially real-world properties can be transformed into virtual properties which can then be traded over the Blockchain ^[18]. Shifting of ownership, registration of property etc can be done on the Blockchain without visiting any government offices. This will increase the turnover of the real estate market. At the same time, the Sovereign Authority can find out who owns what and assess his/her income accordingly. This will increase tax realization and reduce tax burden on the public.

(L) AUTOMATED AUDITING

The P.E. can provide automated auditing services to local governments, corporations and even individuals on a real time basis. The earlier tedious process of manual auditing can be phased out resulting in an automated auditing system. P.E. will, by itself provide the state-of-the-

economy to the Sovereign Authority which can be used for planning and directing of resources to areas /sectors of the economy which necessitate it.

(M) ELECTIONS

Elections involve a large amount of money, manpower, resources and time. In the process, the administration and day-to-day lives of people are affected. Moreover, elections can be manipulated and voters can be coerced to vote against their will. Many a times, the credibility of the election process itself is questionable. In such a scenario, we need an election process that is transparent, fair, inexpensive and convenient.

The Programmable Economy based on Blockchain technology will make it possible to attain a highly credible and verifiable election process at an inexpensive cost. The amount of money saved by using Blockchain Voting Program (BVP) will be immense ^[19]. There will be minimal wastage of time, money, manpower and space. Coercion of voters, the likes seen in many third world countries can be relegated to the side lines. Democracy will not only be feasible, but will be affordable too.

Elections, a hitherto costly and tedious process Election activity may become inexpensive enough, so that governments may automatically opt for Democracy through mobile voting. African nations and other developing Countries, experiencing chaos and problems during power transition will be able afford Democracy which is fair, convenient transparent, and inexpensive.

(N) FIGHTING CRIME

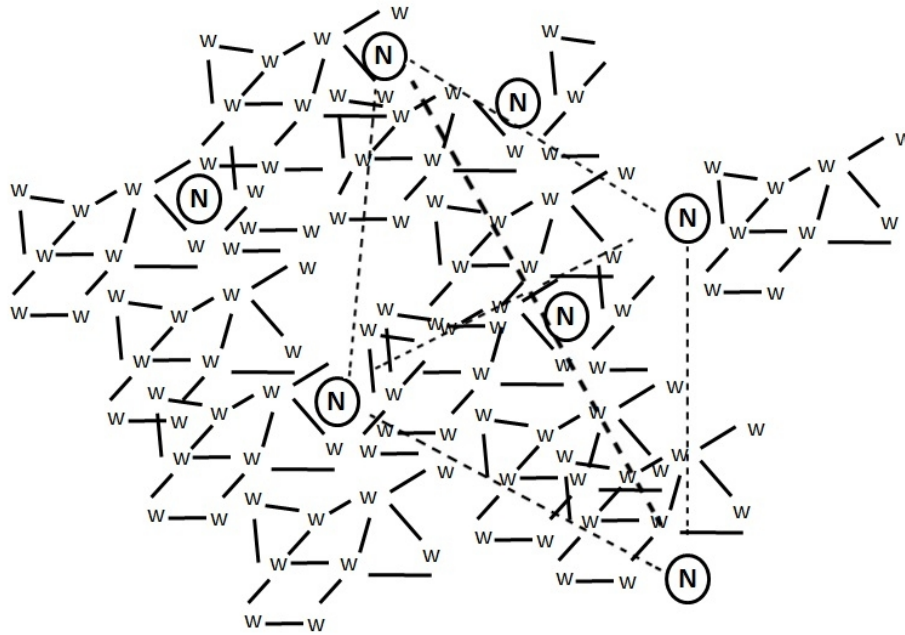
The P.E can also be used to predict and flag pre-meditated criminal activities of various forms. It may be done in the following manner. Imagine that there is a person-X, who intends to commit a crime. Near the time of the supposed commission of the crime there will be

deviations however minute of some nature in his economic activities. Say, he starts having coffee in a place, miles away from his area of work or stay, regularly at particular times of the day. He may buy objects which are not normally bought by persons of his habits or nature. All of these deviations can be picked up by the P.E. If behaviour is found deviant enough, it will be flagged to the authorities who can then place X on surveillance to obtain more clarification about him/her. If surveillance shows suspicious activities, the would-be criminal may be apprehended or dealt as per law.

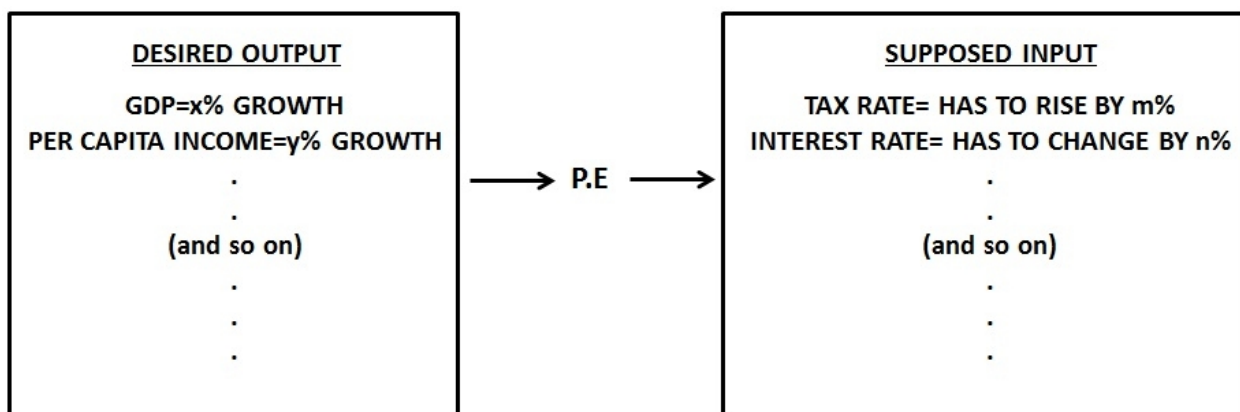
PREDICTING AND IMPLEMENTING FUTURE ECONOMIC SCENARIOS.

The P.E. can both predict (a future economic scenario) and implement (a desired economic outcome). If a country's export increases, the P.E can provide the Sovereign Authority with a scenario on how the economy of the nation will be impacted in the future. At the same time, the Sovereign Authority can input certain data and ask for the estimated output from the P.E. Thus, the P.E will enable the whole national economy to behave like a single computer which can model future economic scenarios as well as implement programs to bring about a desired economic outcome.

N-NODE W-WALLET

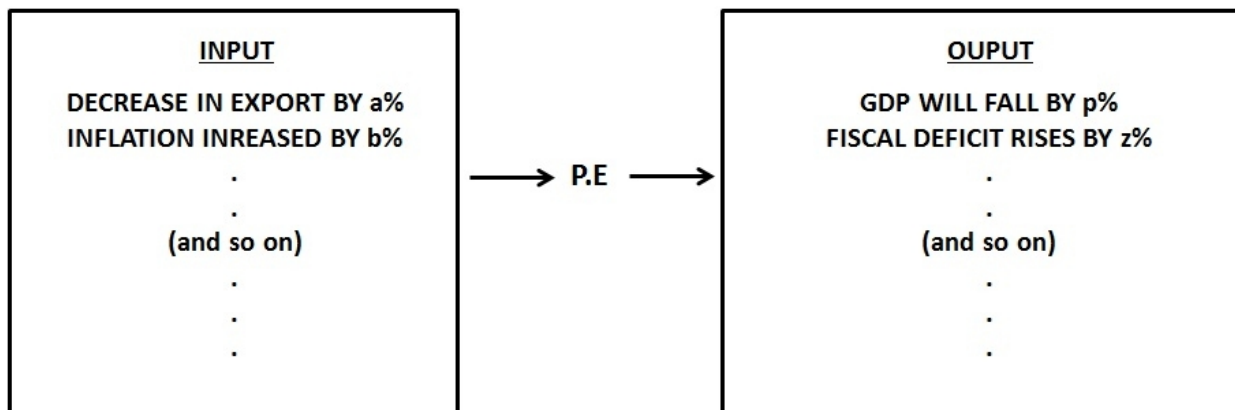


The unique feature of the P.E is that it will not be centralised in any one place, but the whole system of nodes and wallets will act as a single unit. Therefore simulation and implementation of economic scenarios can be done from any place. For example; Sovereign Authority desires to know the output for a particular input.



Here the P.E. will prescribe what all parameters will have to change for the desired output to occur.

If Sovereign Authority desires to know the impact of a particular event, say for example; fall in export earnings then



Various economics scenarios can thus be simulated, with the P.E providing prescriptive changes that can bring about a desired output. The Sovereign Authority has to decide what course to take in order to realize a certain output. Once decided, the Sovereign Authority can set the parameters and instructs the P.E to execute the program. The P.E will then, over a pre-determined timeframe, implement certain changes in various economic parameters to achieve its target. In between, the Sovereign Authority will review the implementation and instruct on course corrections if any. The P.E will predict the outcome based on the data that it already has on previous behaviour of the economy.

VARIABLE FACTORS CONTINGENCY PLAN (VFCP)

A planned economy may prescribe and monitor conditions for economic growth. But what about unforeseen circumstances (like drought, earthquakes, natural calamities, political emergencies etc) which can disrupt and potentially derail an economic plan?

Since planning and predictions will not always be 100% accurate, the Programmable Economy will have a Variable Factors Contingency Plan (VFCP). The VFCP will enable the P.E to tide through unforeseen crises like drought, natural disasters, Geopolitical and economic emergencies etc. (known as Variable Factors). Previous archived data from meteorology, geology, political and economic news items will be fed as data points and the P.E will be enabled to create simulations and strategies in cases where Economic planning will be tedious for Human planners. The P.E will be linked to capital, predictive, commodities and

other markets. This will allow it the leeway to create simulations and plans for contingency situations which may demand a totally new economic plan or a major/minor course correction in the Planned Economy.

THE PLANNED ECONOMY COMMITTEE (PEC) - PROVIDING A ROADMAP FOR A PROSPEROUS ECONOMY.

The PEC will be the organisation that will direct and operate the P.E on behalf of the government i.e. the Sovereign Authority. It will contain (depending on the nation in question) members from the nation's parliament, cabinet, officials, agriculture cooperatives, industry captains etc. It will be led by the Head of the government. Each parameter will be decided by ballot with members having voting powers. The desired output will be deliberated and the final say for implementation will be given. The P.E will start executing the program. The PEC will review the implementation every trimester (once in 4 months) and instruct the P.E on course corrections (if any). The P.E can be given instructions to operate by the Head of government who will have private keys to operate the system. The PEC will also frame rules as to who or which organisations can access which kinds of data and to what extent. The decisions taken by PEC will have to be ratified by the cabinet and the parliament for implementation. (The PEC can also hold people's referendum, through Blockchain voting, on important issues-like raising tax rate etc)

CONCLUSION

We have evaluated centralised, manual economic systems and found out that everything from data collation to implementation of Economic programs is a cumbersome process. Hence there is a need to shift to digital based economy where data collection and programme implementation is easier. Centralised digital economies will most likely be prone to failures and security attacks due to their centralised nature.

Blockchain systems thus provide both the security and flexibility for quick economic operations.

We dealt with how an economy can be transformed into a P.E wherein the whole economy behaves like a single computer with the Sovereign Authority providing inputs and obtaining a desired economic outcome. The P.E will be also able to predict economic scenarios. it will ease the burden of taxation, reduce bureaucratic red tape and simplify economic intercourse for the general public. Thus a transformation from a centralised economy to a Programmable Economy will greatly improve people's control on the course that the economy should take.

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